

Executive Functioning and Language Task Development: The NIH Toolbox

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Executive Functioning

- The capacity to:
 - plan organize, and monitor the execution of behaviors that are strategically directed in a goal oriented manner.
- The TB will focus on:
 - 1.) mental set shifting
 - 2.) inhibitory control
 - 3.) information updating and monitoring



Executive Functioning

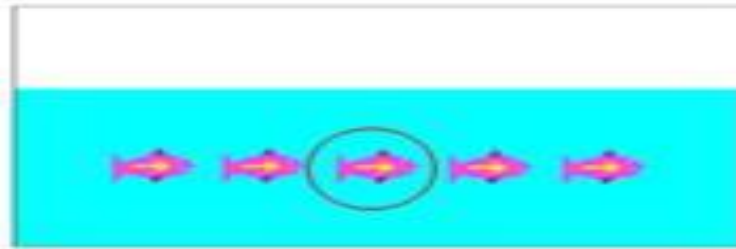
CHOICE REACTION TIME

“FLANKER TASK”

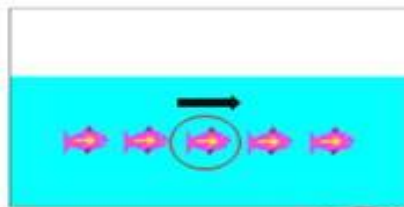
- Computer (Rueda, Posner et al., 2004)
- Measure of inhibitory control: focus on a given stimulus while inhibiting attention to stimuli flanking it

- Stimulus and flankers *congruent*: CPT type task
- Stimulus and flankers *incongruent*: requires inhibition

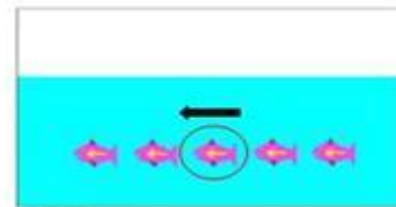
Look at all the fish!!! The fish in the MIDDLE is hungry.



If the MIDDLE fish is pointing this way,
press this button.



If the MIDDLE fish is pointing this way,
press this button.



Flanker: Preliminary Analyses

Average Accuracy on Congruent vs. Incongruent Trials by Age Band

	Percent Correct Congruent Trials- M(SD)	Percent Correct Incongruent Trials- M(SD)
Child (N=31)	81 (24)	73 (27)
Adult (N=41)	99 (1)	99 (3)
Older Adult (N=35)	99 (1)	100 (0)
Total (N=115)	93 (17)	91 (20)

Mean Reaction Time on Congruent vs. Incongruent Trials by Age Band

	RT congruent trials- M(SD)	RT incongruent trials- M(SD)
Child (N=36)	2007.87 (748.09)	2335.76 (1289.73)
Adult (N=41)	814.00 (137.53)	826.48 (138.81)
Older Adult (N=35)	1065.52 (165.74)	1095.31 (148.24)
Total (N=112)	1276.34 (676.92)	1395.62 (986.36)

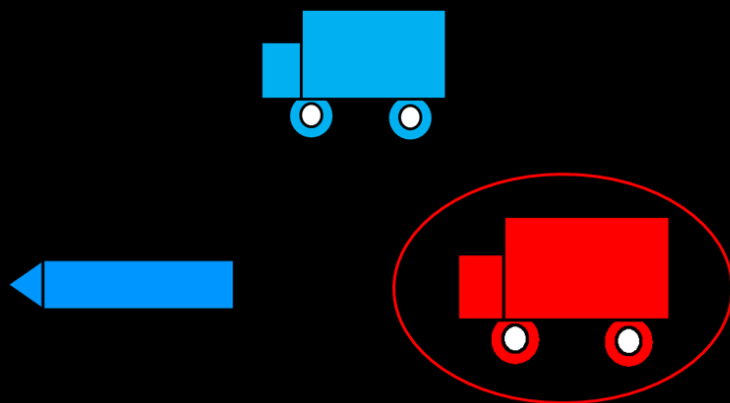


Executive Functioning

DIMENSIONAL CHANGE CARD SORT (DCCS)

- Computer (Zelazo and colleagues, 2003)
- Measures cognitive flexibility.
- Participants must match by shape or color.
- 3 Blocks: shape; color; mixed
- Those who pass the post-switch phase will then complete an adapted form of the task-switching paradigm where the relevant dimension randomly switches (e.g., between “shape” and “color”).

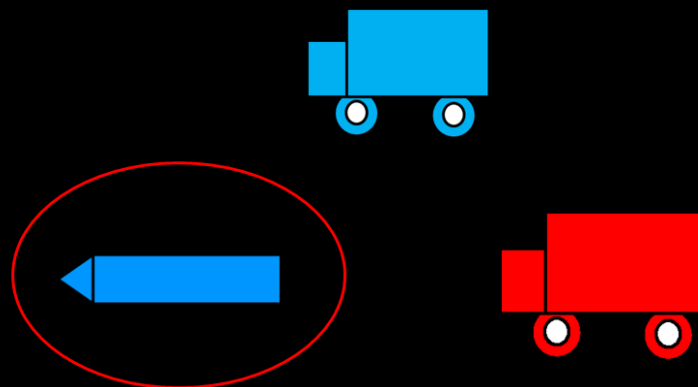
You're going to play a matching game. If you see and hear the word **SHAPE**, press the picture that is the same shape as the picture in the middle of the screen.
If it is a truck, press this picture.



Press the spacebar to continue.

1

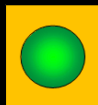
If it is blue, press this picture.



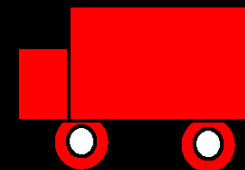
Press the spacebar to continue.

Let's practice! Try to keep your eyes on the + sign you will see in the middle of the screen. Put your index finger on the sticker after you respond, and leave it there until you see the pictures again.

Press the green light when you're ready to start.



Shape



DCCS: Preliminary Analyses

Accuracy by Age Band

	Percent Correct Combined Block M(SD)	Percent Correct Repeated Trials M(SD)	Percent Correct Switch Trials M(SD)
Child (N=26)	71 (21)	75 (23)	68 (22)
Adult (N=41)	98 (4)	99 (02)	97 (05)
Older Adult (N=34)	98 (3)	99 (02)	96 (05)
Total (N=101)	91 (16)	93 (16)	89 (17)

Reaction Time by Age Band

	Combined Block M(SD)	Repeated Trials M(SD)	Switch Trials M(SD)
Child (N=26)	1580.81 (282.52)	1469.58 (304.46)	1776.00 (380.62)
Adult (N=41)	783.16 (161.08)	770.48 (163.45)	815.01 (171.66)
Older Adult (N=34)	1099.10 (249.28)	1048.41 (252.22)	1193.15 (266.71)
Total (N=101)	1094.85 (389.97)	1044.01 (364.18)	1189.69 (467.35)



Executive Functioning

SELF-ORDERED POINTING

- Computer (Petrides and Milner, 1982)
- Participants are instructed to point to one item in an array on the first trial.
- On subsequent trials, the location of objects changes and the subject is instructed to point to a different object, never pointing to the same item twice.
- Different numbers of items in the arrays will also be tried out, depending on the age of the participant.

Now look at these pictures! Press the one you want to pick.





Future Development

- Develop better tutorials to familiarize participants with procedures for using the touch screen
- Simplified instructions and increased use of visual aids for children
- Modify DCCS and Flanker to *improve sensitivity of reaction time* as an outcome measure for adults
- Modify SOPT to improve test/re-test reliability by ensuring participants have reached “true” ceiling



Language

A group of mental processes that serve to translate thought into symbols (words, gestures) that can be shared among individuals for purpose of communication.

The TB will focus on:

- 1) vocabulary knowledge
- 2) oral reading



Picture Vocabulary

- Assesses vocabulary comprehension
- Auditory presentation for multiple choice pictures
- Eliminates literacy load for preliterate and illiterate segments of the population



Picture Vocabulary

Words obtained from the following sources:

- Johnson O'Conner Research Foundation Vocabulary Item Bank (Gershon, 1988)
 - Living Vocabulary (Dale & O'Rourke, 1981)
 - Children's Writer's Word Book (Mogliner, 1992)
 - Dolch Word List (Dolch, 1948)
 - Cognition/Language Subteam
-
- Deliberately oversampled at all levels (initial list ~700 words)
 - Referenced words against Univ Australia MRC Psycholinguistic Database for:
 - Verbal frequency
 - Imagability
 - Age of Acquisition Ratings
 - Items inspected for possible sensitivity concerns
 - End Result: Toolbox item bank that exceeds the minimum number of items required (250).



Picture Vocabulary

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



Picture Vocabulary

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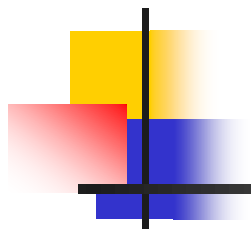
Reading Recognition

- The Goal: to assess the ability to pronounce single words out of context and to recognize and name letters
- Developed list of 420 words and 18 letters
- MRC Psycholinguistics Database



Single vs Grouped Administration

- Reading speed may add a critical component to assessment of reading skill
- Where reading recognition may be high, the construct of reading may be enriched by supplementing pronunciation accuracy with reading speed and flow
- Measurement of reading speed is only possible when words are grouped



number

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Future Development

- A CAT developed for Spanish and English-speakers using item response theory (IRT) methods
- Refine instructions to clarify emphasis on pronunciation
- Develop practice screen
- Discontinue rule for young children
- Final test length = 2 minutes from start to end



Future Steps...

SUBDOMAIN	Toolbox Measures	Validation Measures
EXECUTIVE FUNCTION	Flanker Test (inhibition) DCCS (shifting) Self-Ordered Pointing (monitoring)	CPT-II; DKEFS Stroop DKEFS Sorting EXAMINER Dot Counting
LANGUAGE	Vocabulary Comprehension Bilingual Reading Recognition	Peabody Picture Vocabulary Test-4 Wide Range Achievement Test-4